SD11
.R3

DISEASE DETECTION SURVEY
Air Pollution

Grand Canyon National Park
Arizona

Property of
National FS Library
USDA Forest Service
240 W Prospect Rd
Fort Collins CO 80526

By
Robert C. Loomis
Forest Service, USDA
Division of Timber Management
517 Gold Avenue, SW
Albuquerque, New Mexico 87101

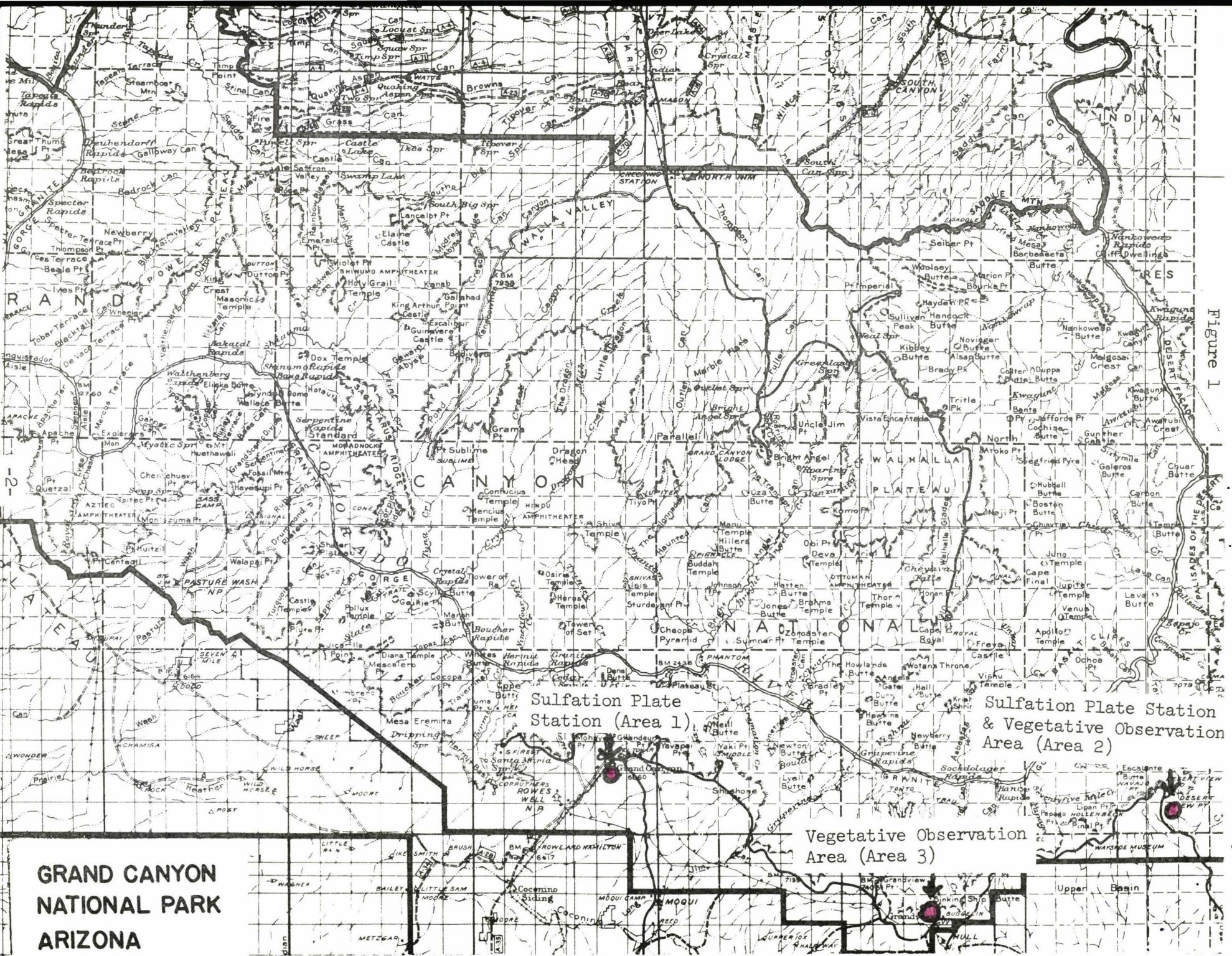
In August 1971, Robert Loomis, plant pathologist in the Forest Service Insect and Disease Branch, examined trees and associated vegetation on the South Rim of the Grand Canyon National Park. The purpose of the survey was to make note of tree and plant condition on selected areas of the Park prior to the scheduled 1974 operation of the Navajo Electrical Generating Station, located near Page, Arizona. No leaf or needle abnormalities were noted which might later be confused with symptoms of possible SO_2 injury.

Method.--A preliminary detection system, consisting of two sulfation plate stations and two vegetative observation areas (Figure 1), was initiated in October 1970. Foliage of trees and associated plants was examined for abnormalities caused by insects, diseases, and environmental factors which might later be confused with symptoms of possible SO_2 injury. In addition to examining tree and plant foliage on the established areas, foliage was examined at several other locations between Grand Canyon Village and the Desert View Park entrance.

Considerations for establishing observation areas include:

1. Presence of a variety of trees and associated plants growing in the area. One phase in evaluating possible SO_2 injury to plants is to determine if similar injury had occurred to a variety of plant species.1/

1/ Air Pollution Control Assoc. 1971. Recognition of Air Pollution Injury to Vegetation: A Pictorial Atlas. Jacobson, J. S., and A. C. Hill. Pittsburgh, Pa.


Sulfation Plate Station (Area 1)
Sulfation Plate Station & Vegetative Observation Area (Area 2)
Vegetative Observation Area (Area 3)
GRAND CANYON NATIONAL PARK ARIZONA
Figure 1

2. The observation areas should have adequate soil moisture. Plants growing in areas with adequate soil moisture and high humidity are more susceptible to SO_2 injury than plants growing under arid conditions.2/

The sulfation plate stations were established in order to get some idea of background sulfation rates. This information, coupled with tree and plant condition observations, may be helpful in the future task of determining whether or not SO_2, emitted by the generating station, has an adverse effect on Grand Canyon National Park vegetation.

Results.--Trees and plants examined for foliage condition include the following:

Ponderosa pine (Pinus ponderosa)
Pinyon pine (Pinus edulis)
Douglas-fir (Pseudotsuga menziesii)
White fir (Abies concolor)
Aspen (Populus tremuloides)
Gambel oak (Quercus gambelii)
Juniper (Juniperus spp.)
Wild currant (Ribes spp.)
Wild rose (Rosa spp.)

No symptoms caused by insects, diseases, or environmental factors were noted which might later be confused with symptoms of possible SO_2 injury. The most prevalent forest diseases noted were southwestern dwarf mistletoe (Arceuthobium vaginatum subsp. cryptopodum) on ponderosa pine; pinyon dwarf mistletoe (A. divaricatum) on pinyon pine; and the true mistletoe (Phoradendron juniperinum) on juniper. A needle mottle or fleck of unknown cause was noted on older ponderosa pine needles. This marking was not evident on the current year's needles.

Sulfation plate data for the period October 1970-October 1971 are as follows:

Area 1 - Grand Canyon National Park

Month	Days exposed	* Sulfation rate (Micrograms $SO_3/cm^2/day$)
Oct. 1970	26	3.3
Nov.	29	** < Detectable minimum
Dec.	34	< Detectable minimum

2/ Ibid.

Area 1 - Grand Canyon National Park (cont'd)

Month	Days exposed	* Sulfation rate (Micrograms $SO_3/cm^2/day$)
Jan. 1971	25	** < Detectable minimum
Feb.	--	--
Mar.	31	3.4
Apr.	30	1.7
May	39	< Detectable minimum
Jun.	22	1.8
Jul.	31	< Detectable minimum
Aug.	30	2.9
Sep.	29	< Detectable minimum
Oct.	31	< Detectable minimum

Area 2 - Grand Canyon National Park

Oct. 1970	26	< Detectable minimum
Nov.	29	< Detectable minimum
Dec.	30	< Detectable minimum
Jan. 1971	29	2.0
Feb.	25	< Detectable minimum
Mar.	34	2.5
Apr.	27	1.9
May	30	< Detectable minimum
Jun.	18	< Detectable minimum
Jul.	28	< Detectable minimum
Aug.	30	3.7
Sep.	22	< Detectable minimum
Oct.	37	< Detectable minimum

* Corning Laboratories, Inc., Cedar Falls, Iowa, supplies and analyzes all sulfation plates.

** Detectable minimum for 30-day period (micrograms $SO_3/cm^2/day$)
Sep. 1970-Mar. 1971 - 1.2
Apr. 1971-Sep. 1971 - 1.0
Oct. 1971 - 0.8

Discussion.--This survey is an effort to get some idea of plant condition and sulfation rate on selected areas of the Grand Canyon National Park prior to operation of the Navajo Generating Station. To date, the only locations we have found acute SO_2 injury to Southwestern forest vegetation have been within 4 miles of the source emitting SO_2. The Navajo Generating Station is located more than

50 miles from the Park boundary, and, therefore, the possibility seems remote that SO_2 emissions from this installation will cause injury to Park vegetation. Nevertheless, the possibility that SO_2 emissions could cause acute or chronic injury to Park vegetation still exists, and, for this reason, sufficient background work should continue so that a more complete final evaluation can be made.

A map is attached which shows the areas included in the 1971 air pollution detection survey.

Recommendations.--

1. Conduct a detection survey on both the South Rim and North Rim of the Grand Canyon National Park in the summer of 1972. This survey would help to increase familiarity with normal plant condition prior to operation of the Navajo Generating Station.

2. Continue meeting with appropriate Park officials to ensure that our respective activities concerned with the possible effects of air pollution on the Park are coordinated.

AIR POLLUTION DETECTION SURVEY - 1971
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION 3